Geotechnical Investigation

Southern Utah University – Lower Quad Pipe Tunnel
South of the Business Building
Southern Utah University
Cedar City, Utah

Prepared For:

WHW Engineering Inc.
1354 East 3330 South, Suite 200
Salt Lake City, Utah 84106

Attention: Mr. Steve Wadsworth

March 11, 2005

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INTRODUCTION

This report presents the results of a geotechnical investigation performed for the proposed Lower Quad Pipe Tunnel located south of the business building and north of the library at Southern Utah University in Cedar City, Utah. The study was conducted in accordance with our proposal (PG003) dated January 21, 2005 your authorization.

The purposes of this investigation were to evaluate the nature and engineering properties of the subsurface soils, and to provide recommendations for general site grading and the design and construction of foundations, floor slabs and exterior concrete flatwork. This study included subsurface exploration, soil sampling, laboratory testing, engineering analyses, and preparation of this report.

We understand that an approximate 7 foot diameter pipe tunnel will be at the subject site approximately as shown on the enclosed site plan. It is also our understanding that pipe tunnel will be constructed of steel or concrete. Structural loads are expected to be relatively low.

The recommendations contained in this report are subject to the limitations presented in the Limitations section of this report. We recommend that all individuals reading this report read the limitations section.

FIELD INVESTIGATION

The subsurface soil conditions were explored by drilling 8 exploratory borings with a Hollow stem drilling rig to depths of approximately 12 feet below the existing site grade. The approximate locations of the explorations are shown on Plate 1. Soils and subsurface conditions, as encountered in the explorations, were classified, logged, and recorded at the time of drilling by our field geologist. The results of the explorations are presented on the enclosed Plate 2 through 9. A key to soil symbols and terms is found on Plate 10.

LABORATORY INVESTIGATION

Representative soil samples from the explorations were tested in the laboratory to verify the field classification and evaluate pertinent engineering characteristics of the soils encountered. The laboratory testing program consisted of unit weight and moisture content determinations, consolidation/collapse tests and solubility tests. The results of the laboratory tests are presented on the boring log summary sheets Plate 2 through 9 and on plates 11 through 16 entitled "consolidation test results" and in the tables of test results.

Soil samples are normally discarded 30 days after submittal of the report unless this office receives a specific request to retain the samples for a longer period.

GENERALIZED SITE CONDITIONS

SURFACE CONDITIONS

At the time of our field investigation the site was covered with sidewalks, lawn and various other vegetation. The site is near the center of the Southern Utah University Campus. The proposed site was bounded by buildings and sidewalks in all directions. The slope of the property is slight down to the west and north.

SUBSURFACE CONDITIONS

Based on the exploration performed for this investigation, the on-site soils generally consisted of soft to medium stiff sandy clay and clayey silt soils interbedded with loose to medium dense silty and clayey sands which extended to the bottom on the holes at boring locations B-1 through B-3. In boring locations B-4 through B-8 the above soils were underlain by medium dense to dense sandy and silty soils which extended to the bottom of the holes.

Groundwater was not encountered within the exploration performed for this investigation. The soils were in a moist to very moist condition throughout the depths explored due to landscape watering and recent rains.

The encountered subsurface conditions are described in detail on the enclosed boring logs, plates 2 through 9. The stratification lines shown on the enclosed boring log represent the approximate boundaries between soil types. The actual in situ transition may be gradual. Due to the nature and depositional characteristics of the native soils, care should be taken in interpolating subsurface conditions between and beyond the exploration locations.

ENGINEERING ANALYSIS AND RECOMMENDATIONS

GENERAL

Based on the subsurface conditions encountered at the site our laboratory analysis and our geotechnical experience in the area, it is our opinion that the subject site is suitable for the proposed construction provided that the recommendations contained in this report are complied with. Specifically, the loose and/or porous materials are not considered suitable for the support of pipe tunnel or pipe tunnel footings. These unsuitable soils should be removed as explained in the following sections of this report. We anticipate that most of the overexcavated soils can be reused for structural fill.

The proposed structures should receive adequate support from conventional strip and/or spread footings founded on a zone of properly placed and compacted structural fill or on medium dense sandy gravel. It is anticipated that medium dense native soils will be encountered along the eastern portion of the pipe tunnel at the bottom of pipe elevation. Overexcavations may be terminated on competent medium dense sandy gravel soils if encountered. Where sandy gravel soils are not encountered at the bottom of pipe elevation, overexcavations on the order of 2 feet below the bottom of the pipe will be required.

Within exterior flatwork, slabs on grade and pavements overexcavations on the order of 18 inches beneath the supporting gravel layer or 18 inches beneath the original ground

surface whichever is greater will be required. Excavations may be terminated if competent medium dense sandy gravel is encountered. Soils should excavatable with a typical tack hoe, however, large boulder could be encountered which will require special excavation techniques.

The following sections of this report present our recommendations for general site grading, design of foundations and slabs-on-grade, soil corrosion, and moisture protection.

SITE PREPARATION AND GRADING

Within the areas to be graded, existing vegetation and debris should be removed and hauled off the site. Any undocumented fill soils and soft, loose, collapsible and/or disturbed native soils should also be excavated to expose competent medium dense native soils or 2 feet below the bottom of pipe tunnel elevation. Excavations may be terminated if competent medium dense sandy gravel is encountered. It is anticipated that competent medium dense sandy gravel will be encountered at bottom of pipe tunnel elevation along the eastern portion of the project. A representative of this office should observe the site grading operations to observe that unsuitable soils are identified and treated as recommended in this report.

Within exterior flatwork, slabs on grade, and pavements, overexcavations on the order of 18 inches beneath the supporting gravel layer or 18 inches beneath the original ground surface whichever is greater will be required.

Excavations should extend laterally at least 3 feet beyond pipe are, or to a distance equal to the depth of structural fill, whichever is greater. The excavations should extend laterally at least 2 feet beyond exterior flatwork and pavement areas. All excavations should be properly laid back in accordance with OSHA requirement. Safety is the responsibility of the contractor. The majority of the on-site soils should be reusable for compacted structural fill but will be very moist when excavated.

Following excavation, of the unsuitable soils as described above, a representative of this office should observe the excavation bottoms prior to the continuance of grading to

observe that unsuitable materials have been removed and that competent soils have been exposed. The native soils exposed after overexcavation should be scarified to a depth of 6 inches, brought to within 2 percent of the optimum moisture content for granular soils and slightly above optimum for fine-grained soils, and compacted to at least 90 percent of the maximum dry density as determined by ASTM D-1557. The site should then be brought to rough pad grade with structural fill as described in the following section.

Subgrade materials supporting slabs-on-grade, exterior concrete flatwork and pavements should be kept moist and not be allowed to dry out and crack. If the subgrade has been disturbed or dried out prior to the placement of aggregate base, the exposed soils should be moisture-conditioned and recompacted as outlined in the Structural Fill section of this report.

We recommend that a representative of this office be allowed to review the grading plans when prepared to evaluate the compatibility of these recommendations.

STRUCTURAL FILL

All fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and pavements should consist of structural fill. Structural fill may consist of excavated on-site or approved imported low plasticity soils (having a remolded swell potential less than 4% under a 60 psf surcharge). Structural fill should have a solubility of less than 3 percent, be free of vegetation and debris, and contain no inert materials larger than 4 inches in nominal size. It is our opinion that the majority of the on-site soils, which are free from organics, are suitable for reuse as structural fill.

Structural fill should be placed in maximum 8-inch loose lifts and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer. Soils in compacted fills should be compacted to at least 95 percent of the maximum dry density, in accordance with ASTM D-1557. The moisture content should be within 2 percent of optimum for granular soils and at least 2 percent above optimum for fine-grained soils. Any imported fill materials should be approved prior to importing. Also, prior to placing any fill, the excavations should be observed by the Geotechnical Engineer to observe that unsuitable materials have been removed.

FOUNDATIONS

Support from conventional strip and/or spread footings founded on a zone of properly placed and compacted structural fill or on medium dense native soils as described previously. All structural fill should be placed and compacted as described in the Structural Fill section of this report.

Any footings should be a minimum of 18 inches wide and embedded a minimum of 30 inches below the lowest adjacent final grade for frost protection. Footings may be proportioned for a maximum net allowable bearing pressure of 1800 psf. A one-third increase may be used for transient wind or seismic loads.

It is our opinion that steel reinforcement should be used in the foundations as per the Structural Engineer's design.

Prior to constructing the foundations, the footing excavations should be observed by the Geotechnical Engineer to observe whether removals have been accomplished.

SETTLEMENTS

Settlements of properly designed and constructed foundations as described in the previous section are anticipated to be less than 1½ inch. Differential settlements should be on the order of one-half of the total settlements. It is expected that the majority of the anticipated settlement will occur during construction.

CONCRETE SLABS-ON-GRADE

Satisfactory support for concrete slabs-on-grade and exterior concrete flatwork may be provided by a 4-inch layer of compacted gravel overlying a zone of properly placed and compacted structural fill. As previously stated, approximately 12 inches of overexcavation is anticipated. The layer of compacted gravel may consist of Type I or Type II Aggregate Base, or pit-run gravel with a 2-inch maximum particle size and no more than 12 percent fines passing the No. 200 sieve.

All concrete slabs should be designed to minimize cracking as a result of shrinkage. We recommend that concrete floor slabs be reinforced as recommended by the Structural Engineer. Reinforcement should be installed at mid-height in the slab unless directed otherwise by the Structural Engineer.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling in the slabs. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

SOIL CORROSION

Soils on this site may contain salts in sufficient concentration to be considered corrosive to metal and concrete. Therefore, all concrete in contact with the on-site soils and used in footings and stemwalls should contain Type V or equivalent sulfate-resistant cement, and should be placed with a 4-inch slump. Special protection to buried metal pipes and water lines will be essential for long term performance of these underground utilities. Consideration should be given to cathodic protection of buried metal pipes, or to the use of PVC pipe where permitted by local building codes.

MOISTURE PROTECTION AND SURFACE DRAINAGE

It is imperative that precautions should be taken during and after construction to eliminate, or at least minimize, saturation of foundation soils due to the moisture sensitive soils that exist beneath the proposed structures. If these moisture protection recommendations are not strictly followed settlements large enough to cause structural damage could still occur.

Overwetting the soils prior to or during construction may result in softening and pumping, causing equipment mobility problems and difficulty in achieving compaction. Saturation of the soils after construction may cause distress to the foundations and flatwork. Positive drainage should be established away from the exterior walls of the structures. The recommended minimum slope is three percent (3%) in landscape areas and two percent (2%) in pavement areas, for a minimum distance of 8 feet from the

structures. Watering adjacent to the structures should be kept to a minimum and properly maintained to prevent overwatering. Roof runoff should be collected into drains and along with other sources of moisture should not be allowed to infiltrate the soils in the vicinity of, or upslope from, the structures.

All utility trenches leading into the structures should be backfilled with compacted non-pervious fill. Special care should be taken during installation of subfloor sewer and water lines to reduce the possibility of future subsurface saturation.

CLOSURE

LIMITATIONS

The recommendations contained in this report are based on the field explorations, laboratory tests, and our understanding of the proposed construction. The subsurface data used in the preparation of this report were obtained from the explorations made for this investigation. It is possible that variations in the soil and groundwater conditions could exist between the points explored. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at the site which are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified.

This report was prepared in accordance with the generally accepted standard of practice at the time the report was written. No warranty, express or implied, is made.

It is the Client's responsibility to see that all parties to the project, including the Designer, Contractor, Subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk.

ADDITIONAL SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during the construction to verify compliance with these recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation, earthwork and structural fill placement.
- Observation of footing excavations.
- Consultation as may be required during construction.

We also recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

CLOSING

We appreciate the opportunity to be of service on this project. Should you have any questions regarding the report or wish to discuss additional services, please contact us at your convenience.

Respectfully submitted,

GEM ENGINEERING, INC.

Joel A. Myers, P.E.
Engineering Manager

JAM /RG021

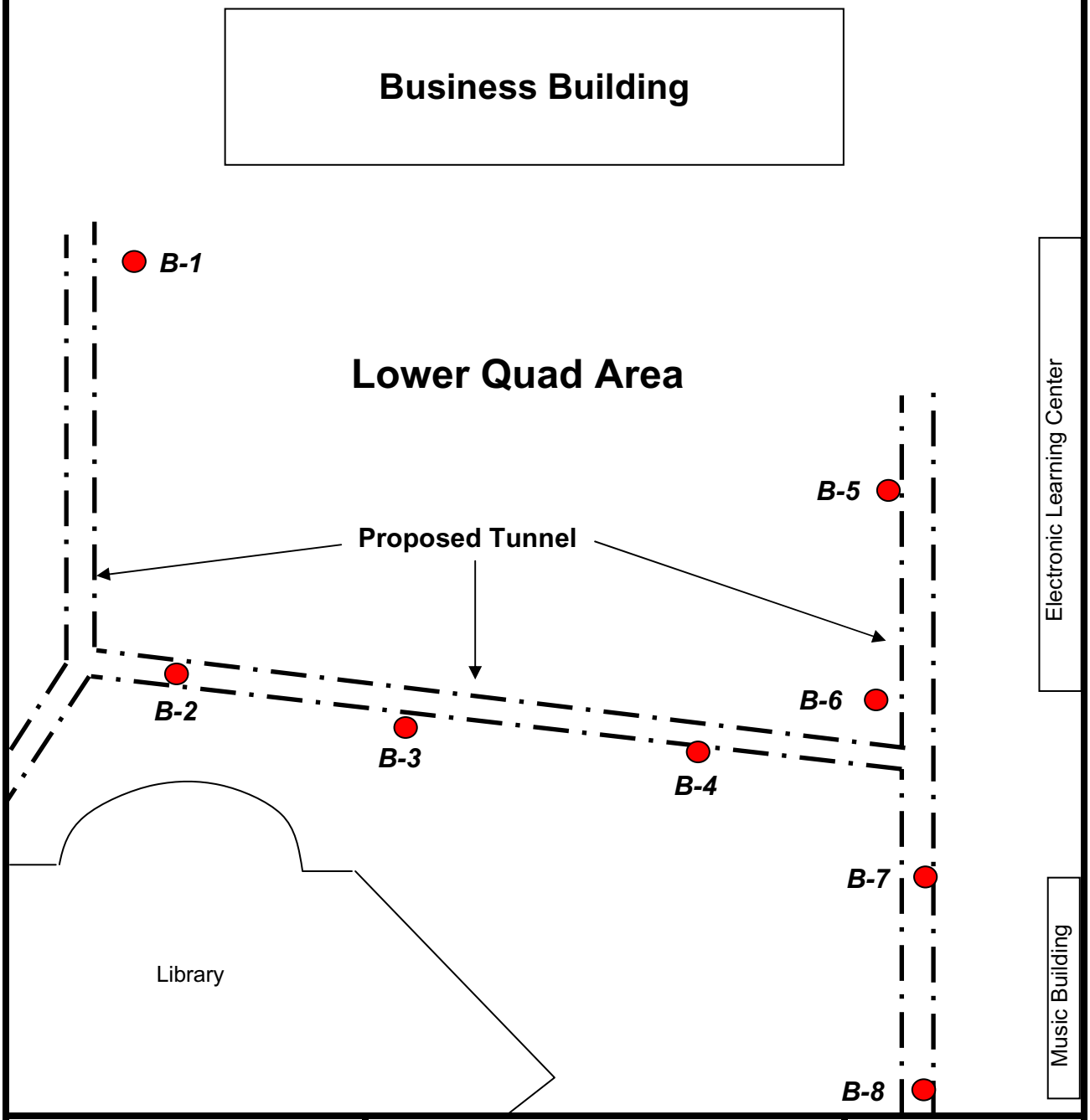
Key

- Approximate Boring Location

Site Plan

Not to Scale

North



GEM **Engineering Inc.**

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Site Plan

SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate

1

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-1

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						CL	(CL) - Sandy Clay with trace Cobble.	Very Moist	Soft
							- One large cobble observed at 1 foot.		
							- Layer capped by lawn.		
	17.9	107	4	AT, C	■				
							- Dark Red Brown	Moist	
5									
	22.8	102	4	AT	■				
10						SC	(SC) - Clayey Sand.		Very Loose
	13.2	103	3		■		- Red Brown		
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 2

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-2

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						CL	(CL) - Sandy Clay.	Very Moist	Soft
	20.9	100	4		■				
							- Dark Red Brown	Moist	
5	26.6	96	3	C	■				
						SM	(SM) - Silty Sand with Gravel.	Slightly Moist	Loose
10	4.9	107	11	C	■				
							- Red Brown		
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

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Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 3

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-3

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						SC	(SC) - Clayey Sand.	Very Moist	Soft
							- Trace amounts of gypsum stringers observed within layer.		
							- Occasional thin light sand lenses observed.		
5	21.7	100	5	AT			- Red Brown	Moist	
						SM	(SM) - Silty Sand with Gravel.	Slightly Moist	Loose
	14.1	100	15				- Layer dominated by medium sand grains.		
							- Up to coarse sand observed within layer.		
10							- Trace clay observed at approximately 11 feet.		
	10.6	109	11	C			- Red Brown		
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 4

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-4

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						SC	(SC) - Clayey Sand.	Slightly Moist	Loose
							- Trace amounts of gypsum stringers observed within layer.		
							- Occasional thin light sand lenses observed.		
	13.4	104	10	SOL					
							- Red Brown		
5						SM	(SM) - Silty Sand with some Clay.		Medium Dense
	14.6	96	24				- Trace gypsum stringers observed within layer.		
							- Light Red Brown		
10	11.9	102	16						
						SM	(SM) - Silty Sand with Gravel. - Red Brown		
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 5

Date Excavated: 2/3/2005

Elev: Not Measured

Location: see plate 1

BORING NO. B-5

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						GM	(GM) - Silty Gravel with some Clay.	Moist	Loose
							- Layer capped with grass lawn.	Slightly Moist	
			8				- Light Brown		
5	9.9	115	15						Medium Dense
						ML	(ML) - Sandy Silt with some Gravel.		Very Stiff
10	13.5	113	36	AT		ML	(ML) - Gravelly Silt. - Light Red Brown		
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type:
- ■ = Drive Sample
- ▭ = Bulk Sample
- ☒ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 6

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-6

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						GM	(GM) - Silty Gravel.	Moist	Loose
						ML	(ML) - Gravelly Silt.		Very Stiff
	12.5	102	77	AT		GM	(GM) - Silty Gravel.	Slightly Moist	Medium Dense
						ML	(ML) - Gravelly Silt.		Very Stiff
						GM	(GM) - Silty Gravel.		Medium Dense
5	16.4	89	30	SOL AT		ML	(ML) - Gravelly Silt.		Very Stiff
						GM	(GM) - Silty Gravel with Cobble.		Medium Dense
						ML	(ML) - Gravelly Silt.		Very Stiff
						GM	(GM) - Silty Gravel with Cobble.		Medium Dense
						ML	(ML) - Gravelly Silt.		Very Stiff
10						GM	(GM) - Silty Gravel.		Medium Dense
			2.5" in 50	AT		ML	(ML) - Gravelly Silt.		Very Stiff
							Bottom @ 12 feet.		
15									
20									

Interbedded Silty Gravel and Gravelly Silt Layers.

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 7

Date Excavated: 2/3/2005 | Elev: Not Measured

Location: see plate 1 | Rammer Weight:

BORING NO. B-7

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						ML	(ML) - Sandy Silt with trace Cobble.	Slightly Moist	Soft
							- One large cobble observed at 1 foot.		Hard
							- Layer capped by grass lawn.		
5	13.2	113	86	C		ML	(ML) - Sandy Silt with trace Gravel. - Light Brown Red		
						GP	(GP) - Cobble lense observed at approx. 7 1/2 to 8 1/2 feet.	Sl. Moist to Moist	Dense
10	16.8	99	28	C		ML	(ML) - Gravelly Silt with Sand. - Some grain cementation possible. - Light Gray Red		Very Stiff
15							Bottom @ 12 feet.		
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

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Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 8

Date Excavated: 2/3/2005

Elev: Not Measured

Location: see plate 1

BORING NO. B-8

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						CL	(CL) - Sandy Clay with very trace Gravel.	Very Moist	Soft
	11.3	115	11	C	■				
5							- Dark Red Brown	Moist	
	7.8	126	68		■	GM	(GM) - Silty Gravel with some Clay.		
								Sl. Moist to Moist	
10							- Dark Brown		
	7.9	99	126		■				
							Bottom @ 12 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

+ Sample Type: ■ = Drive Sample; ▭ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.
- No caving of bore hole.

GEM **Engineering, Inc.**

Project:
SUU - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

Plate: 9

THE UNIFIED SOIL CLASSIFICATION SYSTEM

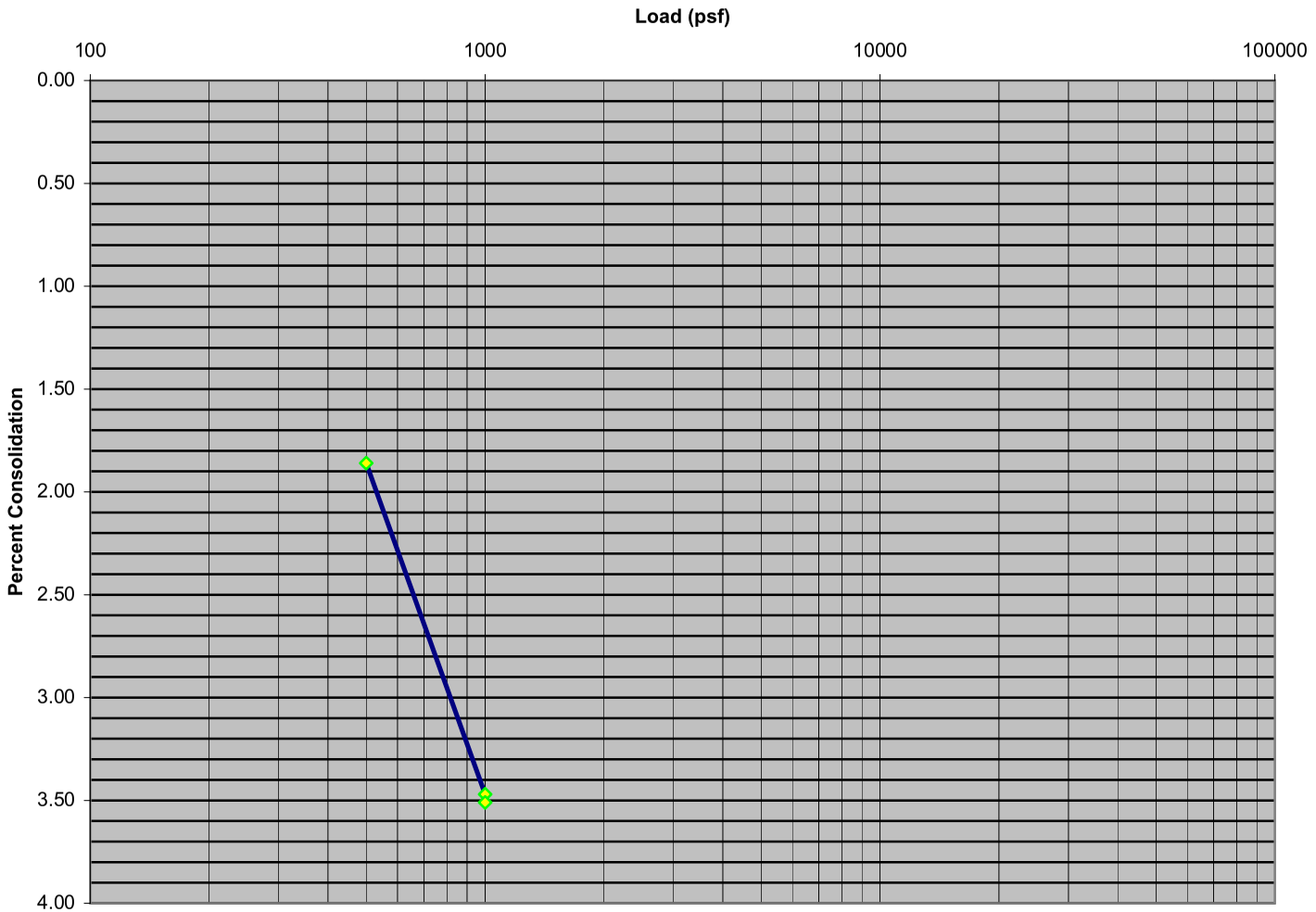
MAJOR DIVISIONS			Group	Symbol	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material is larger than the No. 200 sieve.	**GRAVELS** More than 50 % of coarse part is larger than the No. 4 Sieve.	**CLEAN GRAVELS** Little or no fines	GW		Well graded gravels, gravel sand mixtures, little or no fines
			GP		Poorly graded gravels/gravel sand mixtures
		GRAVELS WITH FINES Appreciable amount of fines	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-sand-silt mixtures
	SANDS More than 50 % of coarse part is smaller than the No. 4 Sieve.	**CLEAN SANDS** Little or no fines	SW		Well graded sands, gravely sands, little or no fines
			SP		Poorly graded sands or gravely sands, little or no fines
		SANDS WITH FINES Appreciable amount of fines	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand clay mixtures
FINE GRAINED SOILS More than 50% of materials is smaller than the No. 200 sieve.	**SILTS AND CLAYS** Liquid limit less than 50		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
			CL-ML		Inorganic clay-silt mixture and very fine sand, silty or clayey fine sands or clayey silts with low plasticity.
			CL		Inorganic clays of low to medium plasticity, gravely Claus, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS Liquid limit greater than 50		MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays or medium to high plasticity, organic silts
	HIGHLY ORGANIC SOILS		PT		Peat and other highly organic silts

GEM ENGINEERING, INC.

Project
Suu - Lower Quad Tunnel,
Southern Utah University,
Cedar City, Iron County, Utah

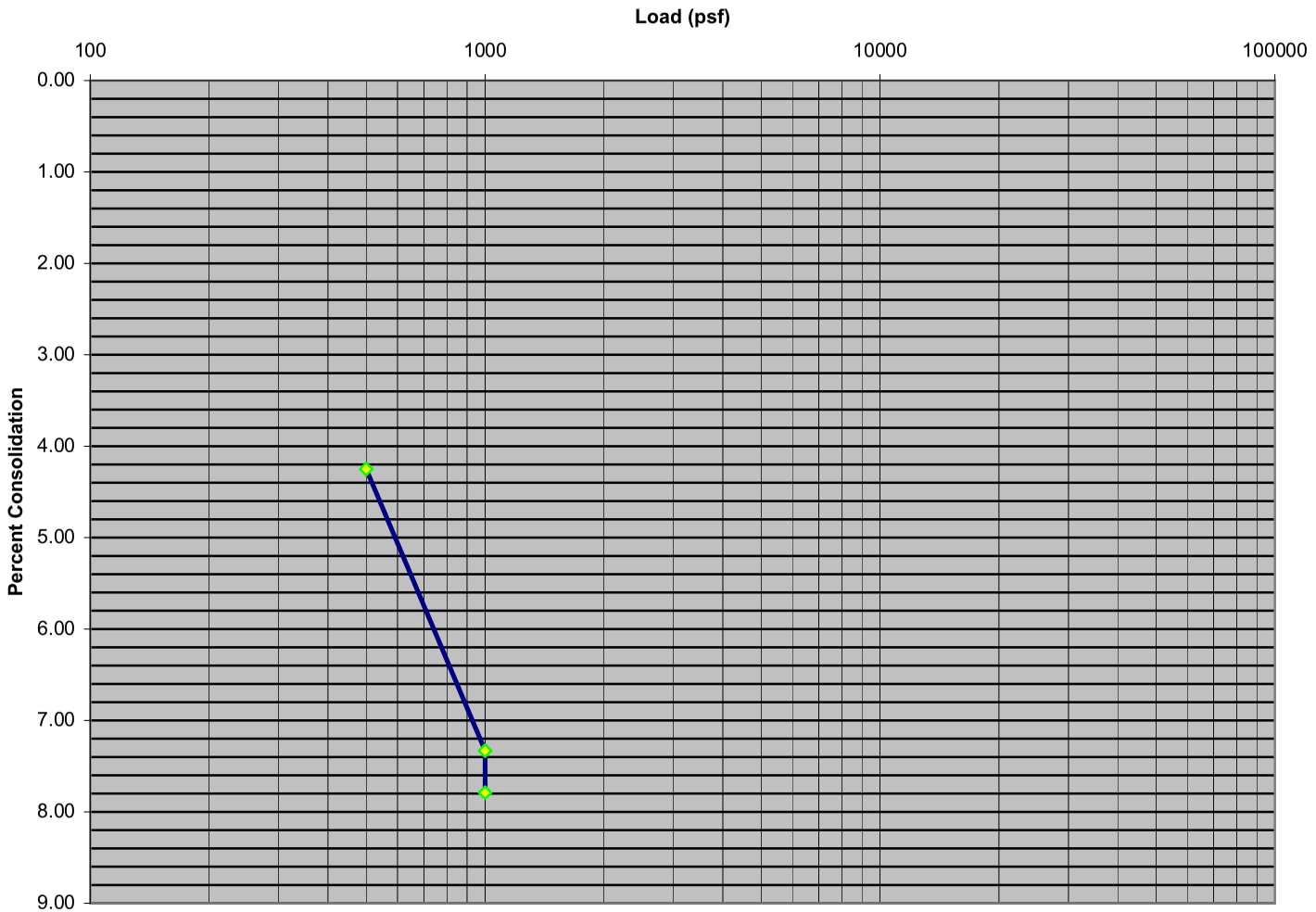
Plate : 10

Consolidation Test Data



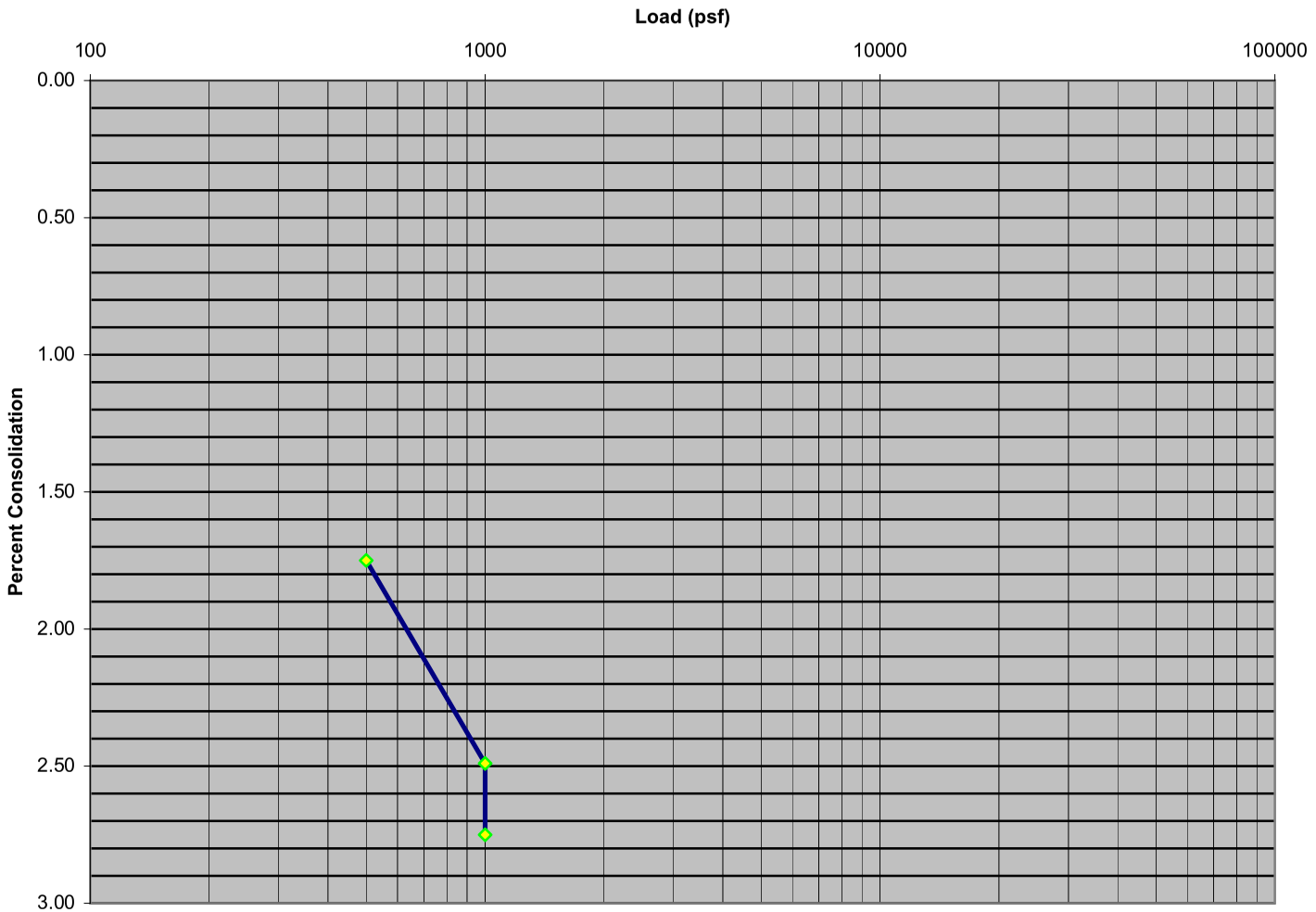
SAMPLE LOCATION B-1 @ 3', Water added at 1000 psf

Consolidation Test Data



SAMPLE LOCATION B-2 @ 5', Water added at 1000 psf

Consolidation Test Data



SAMPLE LOCATION B-2 @ 10', Water added at 1000 psf

Consolidation Test Data

SAMPLE LOCATION B-7 @ 10', Water added at 2000 psf

Consolidation Test Data

SAMPLE LOCATION B-7 @ 4', Water added at 2000 psf

Consolidation Test Data

SAMPLE LOCATION B-3 @ 11', Water added at 2000 psf